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METHOD AND DEVICE FOR INTERLOCKING

The present invention concerns a method and a device for interlocking a disconnecting breaker.

The prior art

Safety regulations have earlier required a disconnecting breaker ~~disconnector~~ with a visually open conductor spacing during work on, for example, a high voltage ~~tension~~ switch gear. According to the traditional solution, a breaker and a disconnecting breaker ~~disconnector~~ have together ensured that the section of the equipment where the work is to be carried out is disconnected. This type of solution requires at least one, and often two, disconnecting breaker ~~disconnector~~ with demanding maintenance in order to ensure their correct function. Each disconnecting breaker ~~disconnector~~ must be correctly installed with a foundation that requires space and expensive installation time. The present invention is intended to solve the problems described above. The intention is to provide a compact solution, reliable from the point of view of safety, that is simple to manufacture and cost-effective for the customer. The construction permits manufacture of the parts according to known technology.

Summary of the invention

The present invention concerns a method and a device for interlocking a disconnecting breaker ~~disconnector~~. The earlier requirement for a visually open disconnecting breaker ~~disconnector~~ has been replaced

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according to new regulations by the requirement for a reliable indication that the section of the equipment is disconnected.

During interlocking of a single-or multiple-poled disconnecting breaker that includes a linkage system, known as a "rod system", for closing ~~operation~~ and opening operation of the contacts of the breaker, the actuator of the breaker is first interlocked both electrically and mechanically. When the breaker is in the open position, the distance between the contacts of the breaker constitutes the conductor spacing of the disconnecting function. The electrical and mechanical interlocking of the actuator is indicated both electrically and mechanically.

The interlocking of the actuator of the breaker is achieved with the aid of an electromagnetic blocking unit that can be operated with a hand-operated key-and lock device. The blocking unit can in one preferred embodiment be operated by remote control. In one preferred embodiment, operation of the hand-operated key-and lock device controls an electromagnet that interlocks a ~~locking~~ blocking package of the actuator of the breaker by both ~~by~~ breaking the operating current to the actuator ~~locking package~~ and by mechanically blocking the actuator ~~locking package~~. The key device is freed from the lock device following the interlocking of the actuator of the breaker and is used in a second lock device for mechanical interlocking of the rod system with the aid of a blocking unit. The rod system is locked in the interlocked condition with a second key device and a third

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lock device. The interlocking of the rod system is indicated by at least one indicator.

According to one embodiment of the device, the second key device is used with a fourth lock device in order to free a blocking unit, which makes it possible to move an earth knife or other earth device. Once the earth knife has been connected to the breaker, the earth knife is blocked in its connected position and locked with the second key device and the fourth lock device.

The electrical and mechanical interlocking of the actuator of the breaker can in one preferred embodiment be achieved with a remote-controlled interlocking device. The remote-controlled interlocking of the actuator of the breaker is indicated by electrical and mechanical indicators on the breaker and by indicators on the remote-control unit. The remote-controlled interlocking device includes the operation of a blocking device for the earth knife, after which movement of the earth knife ~~is~~ causes ~~accompanied by~~ interlocking of the rod system. The system according to the invention is very reliable from the point of view of safety due to the interlocking in one preferred embodiment being performed by the exchange of keys, and due to electrical and mechanical indicators showing in multiple ~~different~~ ways that the breaker is interlocked.

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Brief description of the figures

Fig. 1 shows a sketch of the principle of a disconnecting breaker for a three-phase system.

Fig. 2 shows a sketch of the principle of a disconnecting breaker for a single-phase system.

Figs. 3A-3C show an actuator (a), including an electromagnet (b) and an external surface (c) for operation of a breaker.

Figs. 4A-4B show interlocking of the rod system (a) with a blocking plate and lock (b).

Fig. 5 shows an actuator for an earth knife together with interlocking of the earth knife with a blocking unit equipped with a lock.

Fig. 6A-6C show the disconnecting breaker with earth knives (a), blocking device (b) and rotating disk (c) of the interlocking arrangement of the rod system during remote control.

Detailed description of preferred embodiments

Fig. 1 shows a sketch of the principle of a disconnecting breaker for three poles. An actuator 10 controls a link system, known as a rod system, 20 which connects the poles together and controls the positions of the contacts 30 of the breaker. The positions of the contacts 30 of the breaker are indicated on each pole, for example with a mechanical arrow 70. An earth knife 40 is controlled by its own actuator 50, which is in direct electrical connection with the actuator 10 through a cable 60 connected between the

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actuators. When the disconnecting breaker is interlocked, the actuator 10 is first interlocked both electrically and mechanically with the aid of an electromagnet 12. After this, the rod system 20 of the breaker 30 is interlocked mechanically. The indication is achieved in one preferred embodiment electrically with a lamp and mechanically with, for example, an arrow. The key-and lock device in one preferred embodiment is a Castel lock with the associated keys. When both the actuator 10 and the rod system 20 are interlocked, manual operation and locking of the earth knife 40 according to known technology are possible.

Fig. 2 shows a sketch of the principle of a disconnecting ~~breaker~~ switch for a single pole. An actuator 10 controls a link system, also known as a rod system, 20 which controls the position of the contacts 30 of the breaker. The positions of the contacts 30 of the breaker are indicated, for example, with a mechanical arrow 70. An earth knife 40 is controlled by its own actuator 50, which is in direct electrical connection with the actuator 10 through a cable 60 connected between the actuators. When the single-pole disconnecting ~~breaker~~ switch is interlocked, the breaker is interlocked according to the same principle as the three-pole disconnecting ~~breaker~~ switch.

One embodiment of the present invention provides a device for interlocking a circuit breaker in an open or closed position. In this embodiment, a set of breaker contacts operated by a linking system which is in mechanical communication with an actuator. Operation of the actuator, in

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turn, moves the set of breaker contacts into either an open or closed position by moving the linking system. The position of each of the set of breaker contacts may be indicated by an indicator, for example, by a mechanical arrow. In addition to operating the linking system to open or close the set of breaker contacts, the actuator may further contain devices for interlocking the linking system in the open or closed position by both mechanical and electrical means.

Operation of the breaker is controlled by an ~~, for example, an electromagnet within the~~ actuator driving the linking system. ~~Another~~ An electromagnet is used to position at least one locking shackle so as to mechanically prevent operation of the actuator and maintain the set of breaker contacts in the open or closed position. Electrical interlocking is achieved by disconnecting the operating current to the electromagnet operating the locking shackle after positioning this locking shackle. Therefore, once electrical interlocking has occurred, the positioned locking shackle may not be retracted by the electromagnet until such current is restored. Electrical interlocking may be indicated by mechanical and/or electrical indicators present on the actuator, for example, by illumination of a green lamp and/or a mechanical arrow pointing to a green field.

In one embodiment, the far end of the rod attached to the actuator extends outward from the outer breaker pole housing when the breaker contacts are in the open position and thus allows for it to be mechanically

interlocked by a physical connection, for example, to a blocking plate or other similar device to prevent the rod from moving once in the open position. The visible extension of the rod upon placing the breaker contacts in the open position further serves as an indicator that the breaker is in open position and allowing for interlocking to take place. The position of the blocking plate can be designed to serve as an indicator that interlocking by the blocking plate has been achieved.

Figs. 3A-3C show the actuator 10 for control of the rod system 20 and thus the position of the contacts 30, which includes a blocking package 11 that controls the position of the breaker 30 together with an electromagnet 12 equipped with a mechanical locking shackle 13 or equivalent device. When a first key 18 is turned in the lock 14, the electromagnet 12 releases, whereby operating current to the blocking package 11, which is used for control of the rod system and thus the breaker, is interrupted. Under the condition that the breaker is in the OFF position, the ~~a~~ shackle 13 is released downwards and mechanically blocks movement of the blocking package from the OFF position to the ON position. Indication that interlocking of the actuator is achieved, for example, by the lighting of a green lamp 19 on the external surface of the actuator and by the pointing towards a green field of a mechanical arrow 16 inside the actuator. An auxiliary contact 17 indicates the position of the breaker. When the breaker is OFF and the actuator is interlocked, a signal is sent from the auxiliary contact 17 via the cable 60 to

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the actuator 50 of the earth knife. This is one of the conditions that must be satisfied if movement of the earth knife is to be possible. If the breaker is in the ON position when the actuator is interlocked, the breaker can in one preferred embodiment be automatically ~~breakered~~ switched over to the OFF position. In one preferred embodiment the actuator of the breaker can be interlocked with the breaker in the ON position. The indicator 70 then indicates that the breaker is in the ON position. Movement of the earth knife is not possible in this condition since this requires a signal from the auxiliary contact 17 via the cable 60 to the actuator of the earth knife.

Figs. 4A-4B show part of a link system, known as a rod system, 20 for operation of the contacts 30 of the breaker. The rod system 20 is equipped with a moving part 21 that is in an inner position when the breaker is ON and an outer, visible position when the breaker is OFF. By turning the first key 18 in a second lock 22, manual movement of a blocking plate 23, or other blockage device, is made possible. The blockage plate 23 is pushed in a sideways direction and locked in place with a second key 24 in a third lock 25 such that the moving part 21 and thus the rod system 20 are locked into their outer positions. The interlocking of the rod system can be indicated with, for example, an arrow.

Fig. 5 shows the earth knife 40 with its actuator 50. The position of the earth knife is controlled by a link system 51.

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Figs. 6A-6C show the design of the rod system when remote-controlled interlocking is used. Movement of the earth knife involves movement of the blocking plate 23 via a rotatable disk 80.